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Volume 4, Number 9 (September 1980)

The Solar Ocean Energy Liaison

Solar
OCEAN ENERGY
Liaison

INCORPORATING
The OTEC Liaison

VOLUME 4 NUMBER 9
September 1980

JAPAN ACCELERATES COMMITMENT TO SOLAR ENERGY AND OTEC

Japan's OTEC Budget Up 58%

With Japan dependent on oil for nearly 75% of its total primary energy supply, and with almost 100% of this oil imported from an increasingly-unstable international petroleum market, the Japanese Government is throwing more and more of its resources into diversification.

Toward that end the Japanese initiated the "Sunshine Project" in 1974, with the aim of developing innovative technologies to utilize clean new energy sources including solar energy, geothermal energy, liquefied and gasified coal, and hydrogen energy. The Japanese Government invested about 38 billion yen in the Sunshine Project up to Fiscal Year 1979. The entire program was accelerated by the Energy Technology Development Committee of the Industrial Technology Council in November 1979, and has now passed from the "basic study" phase to the "development" phase.

The Industrial Technology Council is drawn from private industry and works

(continued on Page 4)

UPDATE

TAIWAN UTILITY WELCOMES OTEC FEASIBILITY STUDY

Land-Based, Bottoming-Cycle

Following an early story on the attractiveness of Taiwan as an OTEC plant site (see the January 1980 issue of OE), considerable activity has taken place. An open invitation has been extended by the Taiwan Power Company of Taipei to "every qualified OTEC company" to do a feasibility study for an OTEC plant in that country.

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Above is a recent photograph of OTEC-1 off the coast of Honolulu. The floating test bed for OTEC and components, by Global Marine Development Incorporated, is estimated to cost DOE about $79 million. Delays due primarily to late changes in instrumentation of the cold-water pipe requested by NOAA and DOE have moved the target date of initial deployment off the coast of the island of Hawaii to mid-October.

Solar
OCEAN ENERGY
Liaison

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AN INTERNATIONAL NEWSLETTER ENGAGED AS LIAISON FOR ALL FORMS OF SOLAR ENERGY FROM THE SEA, INCLUDING:
OTEC
(OCEAN THERMAL ENERGY CONVERSION)
WAVE - TIDAL - CURRENT
OFFSHORE WIND - BIOMASS
SALINITY GRADIENTS

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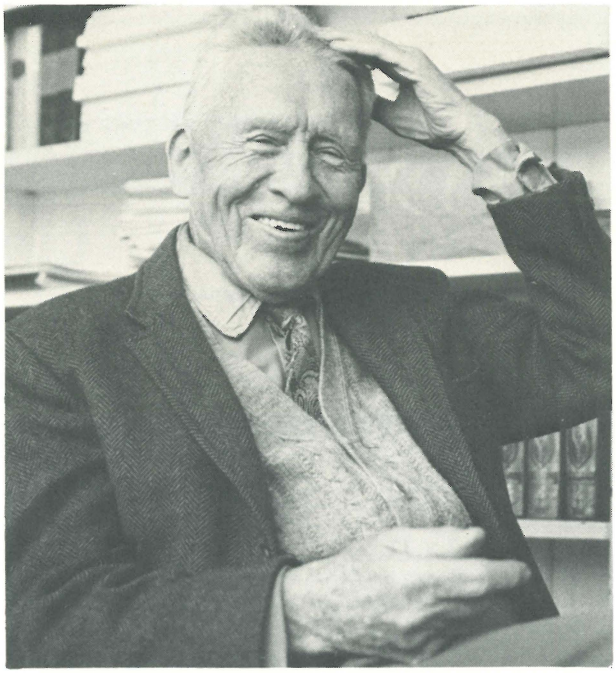


IN MEMORIUM

BRYN BEORSE PASSES AWAY AT 84 AFTER THREE DECADES OF PIONEERING OTEC WORK

Bryne Beorse passed away on April 29th, 1980 at the age of 84, following a stroke. His last 30 years were persistently dedicated to OTEC, with his daily behind-the-scenes efforts consistently bearing fruit. As he was never a glory-seeker, his efforts over many decades toward seeing OTEC implemented are generally unknown and unheralded.

I was notified of Bryn's death while on vacation, and I felt it strongly. Since I became involved in OTEC over four years ago, I had come to know Bryn quite well. We met on several occasions and spoke on the telephone at least twice a month, sharing the many ups and downs of OTEC during that time.

Knowing of Bryn's commitment and long-term involvement in OTEC, I suggested the Bryn Beorse Annual Achievement Award, and hoped it could be initiated at the June Ocean Energy Conference, only to find that there was not enough time to prepare for its selection and proper presentation. However DOE's Dr. Bennett Miller announced at the Conference banquet that the Award would be presented the following year.

Only recently was I reminded that no notice of Bryn's death had appeared in OE, and I realized that this was not simply due to oversight, but because I wanted to provide a proper obituary.

The details of Bryn's story appear elsewhere in this issue, where you will see that he led an exciting, adventurous, creative, and rewarding life.

But I can add to the review of his contributions that he devoted the bulk of the last 30 years of his life to OTEC.

Nowhere do I have a greater collection of papers than in Bryn's correspondence, for he left no stone unturned in his efforts to see OTEC implemented. He wrote everyone who could possibly help, sending me copies of his letters. He wrote Senators, Congressmen, James Schlesinger, magazine editors, Exxon's Chairman, television commentators, current and past Presidents and Presidential candidates, Cabinet members, bank presidents, heads of foreign governments... the list would fill the pages of an international "Who's Who".

And not only did he get answers, but Bryn held dialogues with these men: meaningful dialogues that often culminated in personal meetings, television appearances, and feature newspaper and magazine articles. It makes exciting reading.

More important, Bryn did more to "get the word out" on OTEC than anyone else I know of. For example his initial appearance on Arlene Francis's talk show resulted in more letters than they had received following anyone else's appearance, and Bryn was asked back for two more visits.

The last time I spoke with Bryn we discussed the rapid movement of OTEC legislation through Congress. It was a few weeks before he died, and I asked him if he was working hard. "No, not really," he told me. "I believe OTEC is really, finally on its way now."

Bryn had incredible energy and stamina, even though he was in his mid-eighties. After so many years of fighting for OTEC, I believe he felt his job was done. OTEC was certainly well on its way: The word was out, the momentum was there. Now he could rest.

Richard A. Meyer
Editor and Publisher

SOLAR OCEAN ENERGY

ABOUT BRYN BEORSE: HIS HISTORY

Bryn Beorse was still working as a research associate at the Seawater Conversion Laboratory of the University of California in Richmond at the time of his death at the age of 84.

Bryn was born in Oslo, Norway on April 26th, 1896. He graduated from the Royal Norwegian Technical University with a master's degree in engineering, then began a period of world travel in which he visited and lived in 67 countries, working in several of these and learning 12 languages.

He served in both World Wars, with the Coastal Defense forces in Norway in World War I and with the British Air Force in World War II, attaining the rank of captain and serving with MI 6, the Air Force Intelligence Agency.

After World War II he went to France to work on engineering studies, during which he was introduced to Ocean Thermal Energy Conversion while working for the French company Energie des Mers on the design and construction of the Abidjan (Africa) OTEC plant in 1947. He brought this system to the United States in 1948.

After returning to the US, Bryn settled in Berkeley, where he did pioneering work in seawater conversion and ocean thermal power at the Seawater Conversion Laboratory of the University of California, where three laboratory OTEC models were built.

He left there around 1960 to work for the McDonnell Douglas Corporation, then went to work for the Boeing Aircraft Corporation in Seattle. During his subsequent year-long visit to Switzerland he worked for Hispano-Suiza, then returned to the US in 1962 to work for the Navy in Keyport, Washington.

In 1964 Bryn headed a United Nations mission to Tunisia to determine the feasibility of setting up seawater-conversion plants there. Taking advantage of a 15-year right-to-work rule in the Civil Service, he avoided mandatory retirement from the Navy until December 1976, when he became one of the oldest civil servants in the US at the age of 81.

Returning to the University of California at Berkeley, he again took up his major goal: the development of Ocean Thermal Energy Conversion.

Bryn was the author of nine books, primarily on various aspects of energy and economics, but also including armchair philosophy and knowledge gleaned from his many years of travel. His latest books are *Fairy Tales Are True* and *Every Willing Hand,* available from HU Press, 242 East 14th Street, New York City. Others include *Essays on Full Employment, The Future Is Ours,* and *The State of Almost Happiness.*

Bryn is survived by his wife, Evelyn, a son, a daughter, and two sisters. At his request his remains were donated to the University of California at San Francisco for scientific use.

ABOUT BRYN BEORSE: THE MAN

Anecdotes by and about Bryn Beorse abound; an attempt at brevity is somehow a disservice to him.

● Just a month before his death, Bryn canceled the "Exxon Caper", a plan in which, by buying minimal stock, he could have a voice at Exxon's annual stockholders' meeting enabling him to "persuade" Exxon to back OTEC development. His letters brought two Exxon vice-presidents to visit, resulting in the promise of more OTEC R&D by that company. Bryn had accomplished his purpose. He saw Exxon "in an excellent position to lead this nation to affluence and international helpfulness—and make huge profits in the bargain".

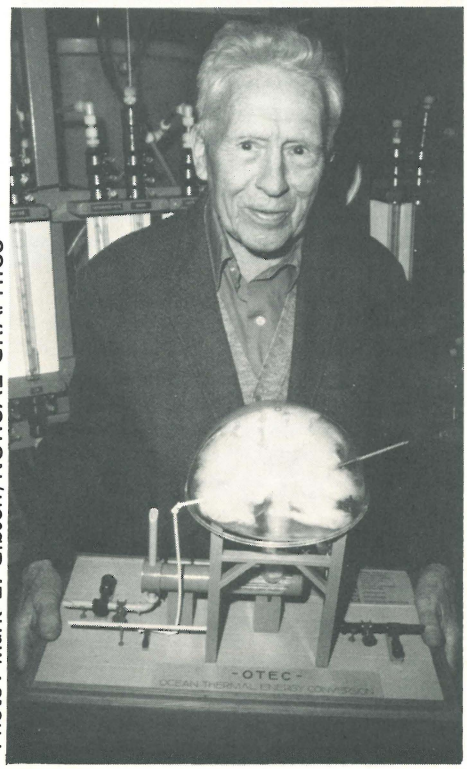


Photo: Mark E. Gibson/NORCAL GRAPHICS

Bryn Beorse at his University of California laboratory displaying a model of a bottom-mounted, open-cycle OTEC plant designed to produce both fresh water and electricity.

● After 11 years of discouragement in attempting to implement OTEC, Bryn ran away to the Himalayas. One day a storm forced him to seek shelter in a cave, only to find it already inhabited. Upon hearing a sound from within, Bryn reached into the darkness and grabbed a handful of bristly fur, resulting in another sound he said he'd never forget. "A Himalayan bear told me to get out of there and go back to work on OTEC," he said, "so here I am back in the world."

● I told Bryn years ago that I wanted to do a biography on him, but he declined, saying he was only an "uncute lad". Yet I later learned that in 1943 he had planned, along with several German generals and the British MI 5 and MI 6 (the equivalent of the American CIA) to kidnap Hitler and "place him in a nice British apple orchard where he could spend the rest of his life munching apples and complaining to newshawks". I also learned of Bryn's being attacked by a Dayak chief in Borneo who wanted his blond head ("since it counted for nine dark ones"). "A story about me? Are you kidding? Not worth the ink."

● While Bryn encouraged everyone, he challenged many. Not out of antagonism, but to spur them on to do their best and to live up to the standards he had set for himself.

● In recent years Bryn worked with several foreign governments on an OTEC desalting process which he claimed "could operate on only a 9°C total thermal difference and with only a fourth of the energy input of any other distillation desalting project".

● Bryn had several talks on OTEC with Prime Minister Nehru in India in 1959, and continued his correspondence with Indian energy advisors as recently as late 1979. Similarly with the National Research Centre of Cairo on utilizing the hot brines of the Red Sea through OTEC technology.

● At a meeting of the Solar Energy Research Institute (SERI) in December 1979 Bryn found out during a talk with Eric Midboe of Gibbs & Cox that he had taught Eric's father in Norway many many years before.

One especially-memorable passage from Bryn's correspondence ended as follows: *"....or 8 to 10 other alternative energy systems. Or all of them. But if we don't start an energy crash program now, today, so we can stop all oil imports in 15 years, we are going down toward complete destruction—all nations—however beautifully we chitchat about island OTECs for the next 25 years and so 'necessary' additional research in heat exchangers and biofouling."*

Having just re-read Bryn's correspondence—incredible in both its quantity and its quality—with dozens of people in high places, world-renowned thinkers, and the like, I had hoped to excerpt highlights. But it is impossible to do so effectively except in a book. Suffice it to say that when one reviews Bryn's letters to DOE, Congressmen, the OTA, bank and university presidents, and others, one is forced to acknowledge the tremendous influence he had over the years—right up until his death—in advancing OTEC to where it is today.

All behind the scenes, quietly, persistently, and always with good humor.

His life has been an inspiration to all who knew him.

Thank you, Bryn!

—R. A. M.

(continued from Page 1)

Taiwan's Energy Picture

With imported fuel now providing 80% of its power requirements, and with virtually no domestic energy resources, Taiwan has little choice but to expand its program of nuclear-power-plant construction. The recent increases in the price of imported oil have pushed that country's balance of payments into the red for the first time in years.

Yet Taiwan continues to be the world's fastest-growing industrial nation, with its GNP still riding high.

The Government of Taiwan plans for an eventual energy mixture of about 45% nuclear power, 27% coal and liquefied natural gas, and only 26% oil.

The first two nuclear reactors went into operation in 1978, and four more under construction are to come on line before 1983. Taipower will soon invite bids on the seventh and eighth nuclear units, and plans to continue to add at least one reactor each year until there are 20 in service by the late 1990s.

To achieve this goal, the Taiwanese will have to overcome problems of safety, uranium supply, and waste disposal as well as a brain drain of qualified technicians. However safety and environmental concerns do not have the same effect of stymying or slowing down such plans in Taiwan as they have in other parts of the world.

Nuclear Energy and OTEC as Partners

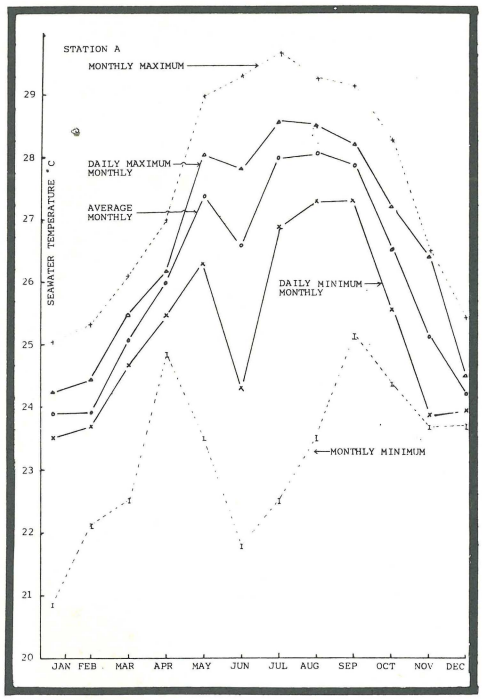
An innovative proposal has been received by OE from Professor Nai-Kuang Liang of the National University of Taiwan's Institute of Oceanography to couple the effluent from a nuclear plant, as the warm-water source, with deep cooling water from near offshore. Taipower has expressed interest in this proposal.

Although Taiwan has an adequate natural delta-T for an OTEC plant (see the January 1980 issue of OE), due to its subtropical latitude and its proximity to the warm Kuroshio current nearby, the efficiency of a bottoming-cycle operation is considerably increased.

The first two units of the third nuclear power plant are now under construction at Taiwan's southern tip, with seawater to be used as the cooling water. Each unit requires 43.25 CMS of cooling-water discharge, to be heated to an increase of 10.2°C. Seawater temperature variation is shown in the adjacent graph.

Fortunately, only about 1300 meters from shore the water depth exceeds 300 meters and the water temperature is about 12°C to 15°C lower than that of the surface seawater. By utilizing the heated cooling water from the nuclear plant and the water from 300 meters, a delta-T of about 22°C to 25°C is available.

While this delta-T is comparable with that which is naturally present, the cold-water pipe required is much shorter—even shorter, in fact, than those of proposed



land-based OTEC plants in Puerto Rico or Hawaii.

At least one American firm has been to Taiwan within the last four months to discuss a feasibility study with Taipower. Japanese firms also have been marketing their services with the utility.

The most-recent information from Taiwan indicates that further definition of basic offshore data at the proposed site is currently under way.

Dr. James Roney, head of Princeton Energy and Environmental Research of that city, visited Taiwan, Guam, and Japan recently, and tells us that there is "tremendous activity and excitement" taking place in that part of the world regarding potential OTEC sites. He shares our opinion that it is more than likely that that part of the world will be the site of the world's first commercial OTEC plant.

UPDATE

DESIGN STUDY FOR IVORY COAST OTEC PLANT TO EUROPEANS?

The interest of the Government of the Ivory Coast in building an OTEC plant in Abdijan, due to its excellent natural resources and narrow continental shelf (see the April 1980 issue of OE), continues, but has taken a new tack.

While an offer was in the works as recently as last spring regarding a cost-sharing arrangement with DOE supplying 70% of a $1 million feasibility study for the project, federal budget-cutting efforts have killed that plan.

However, a consortium of European companies has been negotiating with the Ivory Coast Government, and OE understands that a contract will be signed for that feasibility study by late November or early December.

(continued from Page 1)

closely with the Ministry of International Trade and Industry (MITI), the lead agency of the Japanese Federal Government.

1980 Budget Almost Equals That of Last Five Years Combined

As one indication of this acceleration, Japan's total budget for solar R&D from FY 1974 through FY 1979 was 10,700 million yen, while the planned solar budget for FY 1980 alone is 9,550 million yen. Comparative figures for the 1980 budget are 8,600 million yen for geothermal energy, the same for coal, 950 million yen for hydrogen energy, and 8,600 million yen for supporting research and management for all energy sources combined. The total Sunshine Project budget for 1980 alone is 36,300 million yen, which compares with 37,550 million yen for the period from 1974 through 1979.

At the rate of 209 yen per dollar, this translates to over $40 million for solar R&D, compared to just over $100 million in the US Department of Energy Solar Budget for FY 1980. While a direct comparison of the two solar budgets is like a comparison of apples with oranges, a more significant observation comes from looking at the Sunshine Project's proposed solar-energy budgets for the next ten years.

From 9,550 million yen for the period from FY 1974 through FY 1979, the Japanese budget jumps to 70,000 million yen for the period from FY 1980 through FY 1985, and 30,000 million yen for FY 1986 through FY 1990. However for the period from FY 1986 through FY 1990 the report indicates another 200,000 million yen from "private funds provided additionally".

A footnote adds: "Public funds are to be provided in relation to the research and development activities ending with the development of a demonstration plant, and to the development of the first commercial plant private funds are to be provided."

The total estimated funding for all the programs of the Sunshine Project—including both solar energy and the other energy sources mentioned above—is 0.7 trillion yen for the period from FY 1980 through FY 1985, with 0.58 trillion yen in public funds and 0.12 trillion yen in private funds, or about 20% in private funds for the next five years.

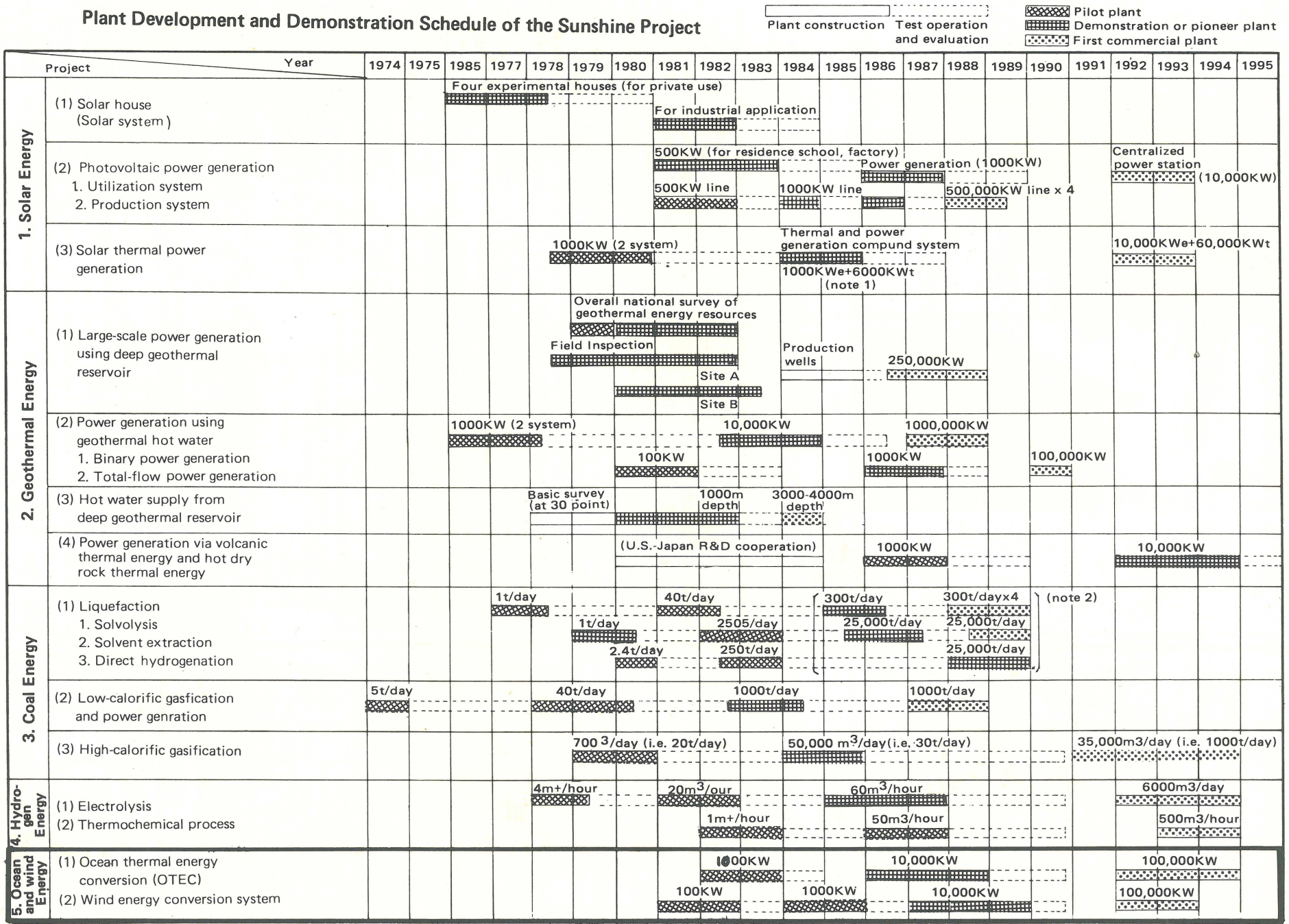
We are taking the liberty of publishing the entire Plant Development and Demonstration schedule of the Japanese Sunshine Project in this issue, not only to show how the Japanese project their OTEC program, but also to provide a basis for comparison with other energy technologies.

OTEC Budget Up 58% for FY 1980

One added note: In another table included in the 13-page report, funding for "supporting research and management" for the "expansion of research on OTEC technology" shows an increase of 58%—

(continued on Page 6)

Plant Development and Demonstration Schedule of the Sunshine Project



(Note) 1. KW and KWe refer to the electric output, and KWt to thermal output.
2. A further detailed study is to be made on the coal liquefaction process at the stage when a demonstration plant will be developed.

(continued from Page 4)

from 360 million yen in FY 1979 to 567 million yen in FY 1980. As most readers of OE are aware, this compares with a *reduction* in the US Department of Energy budget for OTEC from $54 million in FY 1980 to $45 million for FY 1981.

Unless rapid changes are made in US policy toward accelerating the development of renewable energy, Japanese industriousness and progressive planning will result in that country's soon taking over the lead in OTEC technology.

NOAA SETS OTEC ENVIRONMENTAL HEARING FOR OCTOBER 30TH

Written Comments Accepted Until November 7th

The National Oceanic and Atmospheric Administration (NOAA) is preparing the environmental-impact statement (EIS) on the licensing regulations for OTEC facilities and plant ships, with a public scoping meeting scheduled for 9 am Thursday, October 30th, in Room 4830 of the Department of Commerce Building in Washington DC. The meeting will "determine the scope of environmental issues to be addressed and the significant issues related to the federal action". Written comments will be accepted until November 7th, 1980 at the address appearing at the end of this article. The EIS draft will be published in March 1981.

The announcement of the meeting in the *Federal Register* further states that "the administrator of NOAA has decided to prepare an EIS on the selection of a regulatory strategy that will implement that program. The EIS will (a) assess the environmental impacts associated with development of OTEC as a commercial energy technology; (b) describe and compare alternative strategies for the development of regulations; (c) set forth a preferred alternative strategy; and (d) identify areas where more information is needed or desirable."

Further information is available from Lowell Martin, Office of Ocean Minerals and Energy, NOAA, Room 410, Page Building 1, 2001 Wisconsin Avenue Northwest, Washington DC 20235, (202) 653-7695.

CORRECTION

In the story appearing on Page 2 of our August issue entitled "SERI Study Shows Energy Use to Plummet, Solar to Provide 20% to 33% by the Year 2000", we inadvertently failed to credit the *Solar Energy Intelligence Report* (SEIR) as the source of our information.

SEIR thoroughly covers information regarding all of the solar technologies, and is published by Business Publishers Incorporated, PO Box 1067, Silver Spring, Maryland 20910.

US GOVERNMENT PROCUREMENT INVITATIONS AND CONTRACT AWARDS

Listed below are contract awards and procurement invitations related to solar ocean energy culled from the Commerce Business Daily. This is not to be construed as a complete list.

Sep 9: Additional Bibliographic Searches on Technical Subjects Related to Energy Research: Negotiations are now being conducted with Lockheed Missiles and Space Company, Palo Alto, California 94304, for Solicitation AC-01-79-AD-10617.A002. Department of Energy, Office of Procurement Operations, Washington DC 20585, (202) 376-9290.

Sep 9: Development of New Business Opportunities for Minorities in the Synthetic Fuels Program: Contract AC-01-80M-101005 awarded to Ronson Management Corporation, Alexandria, Virginia 22304.

Sep 9: Eucalyptus Plantations for Energy Production in Hawaii: Contract DE-FC-03-78-ET-20074, Modification A003, awarded to Bioenergy Development Corporation, PO Box 1801, Hilo, Hawaii 96720. US Department of Energy, San Francisco Operations Office, 1333 Broadway, Oakland, California 94612.

Sep 9: Waste Heat Management in the Electric Power Industry: Contract DE-AC-02-76-EV-04114.A004, $25,000, awarded to Massachusetts Institute of Technology, Cambridge, Massachusetts 02139. US Department of Energy, Chicago Operations and Regional Office, 9800 South Cass Avenue, Argonne, Illinois 60439.

Sep 9: Cogeneration of Electric Energy and Useful Chemicals in a Fuel Cell: Contract DE-AC-02-80-ER-10694.A000, for $150,076, awarded to Massachusetts Institute of Technology, Cambridge, Massachusetts 02139. US Department of Energy, Chicago Operations and Regional Office, 9800 South Cass Avenue, Argonne, Illinois 60439.

Sep 9: Feasibility of Using Saturated Solar Ponds for Heat Rejection: Contract DE-AC-02-80-CS-80013.A000, $27,108, awarded to Intertechnology/Solar Corporation, Warrenton, Virginia 22186. US Department of Energy, 9800 South Cass Avenue, Argonne, Illinois 60439.

Sep 9: Research Entitled "Continental Shelf Processes Affecting the Oceanography of the South Atlantic Bight": Contract DE-AS-09-76-EV-00902, $265,833, awarded to North Carolina State University, Raleigh, North Carolina, US Department of Energy, Savannah River Operations Center, PO Box 1, Aiken, South Carolina 29801.

Sep 12: Photo Decomposition of Water in Homogeneous Solution: Contract DE-AC-02-79-ER-10457.A001, for $60,009, awarded to Carnegie-Mellon University, 5000 Forbes Avenue, Pittsburgh, Pennsylvania 14213.

Sep 12: Hydrogen Derived From Solar Energy: Contract DE-AC-03-80-ER-10190, for $39,500, awarded to SRI International, 333 Ravenswood Avenue, Menlo Park, California 94025. US Department of Energy San Francisco Operations Office, 1333 Broadway, Oakland, California 94612.

Sep 15: Energy and the Economy: Contract DE-AC-02-80-PE-70228.A000, for $80,000, awarded to Massachusetts Institute of Technology, Cambridge, Massachusetts 02139. US Department of Energy, 9800 South Cass Avenue, Argonne, Illinois 60439.

Sep 18: Renewable Non-Conventional Energy Project (Thailand): Contract AID-493-9032-T, for $2,097,605, awarded to Meta Systems Incorporated, 10 Holworthy, Cambridge, Massachusetts 02138. Agency for International Development, Small Business Office, Washington DC 20523.

Sep 19: Non-Acid Pre-Treatment and Management of Micro-organisms in Seawater Desalination by Reverse Osmosis: Contract 14-34-001-0466, for $163,842, awarded to Permutit Company Incorporated, 567 Ridge Road, Monmouth Junction, New Jersey 08852.

Sep 23: Cook Inlet Tidal Power Feasibility Study: The Office of the Governor, Division of Policy Development and Planning, is requesting proposals from organizations indicating ability to undertake a study to assess the potentials and constraints of utilizing the tides of Cook Inlet, Alaska, to generate electric power. Proposals will be accepted though October 20th, 1980. Office of the Governor, Division of Policy Development and Planning, Pouch AD, Juneau, Alaska 99811, Attention Frances Ulmer.

Sep 24: Research on Titanium Welding Metallurgy: Contract N00014-80-C-0607, September 3rd, 1980 (no RFP), $210,000, awarded to the Colorado School of Mines, Golden, Colorado 80401.

Sep 29: Strategy for Offshore Technology Research and Development: Negotiations are being conducted with Energy Interface Associates, Palos Verdes Estates, California 90274, for Solicitation AC-01-79-ET-14072. Department of Energy, Office of Procurement Operations, Washington DC 20585, (202) 376-9290.

Sep 29: Government/Solar Industry Interface Analyses: Negotiations are being conducted with Mitre Corporation, 1820 Dolly Madison Boulevard, McLean, Virginia 30487, for Solicitation AC-01-80-CS-30487.

Sep 29: Responses on Possible Oil Supply Disruptions: Negotiations are being conducted with Data Resources Incorporated, 29 Hartwell, Lexington, Massachusetts 02173, for Solicitation AC-01-80-PE-70308. Department of Energy, Office of Procurement Operations, Washington DC 20585, (202) 376-9290.

Sep 30: Ceramic Heat Exvhanger Technology Advancement: Negotiations are being conducted with Solar Turbines International, 2200 Pacific Highway, San Diego, California 92138, for Solicitation AC-01-80-ET-13712.